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Author(s): Joseph Connors
Reviewed work(s):
Published by: The Warburg Institute
Stable URL: http://www.jstor.org/stable/751348
Accessed: 31/12/2011 19:16

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ARS TORNANDI:
BAROQUE ARCHITECTURE AND THE LATHE
Joseph Connors

Rembrandt has several paintings of the Holy Family which show Joseph as the timeless village carpenter, whose shop is his cottage and whose hand-tools have changed little since the Roman empire (Pl. 22a). He rough-hews a stick of wood with an adze, and will go on to to finish it with the help of the auger, hatchet, bow-drill, brace and bit, plane, chisel and saw. He seeks no help from drafting instruments or from wood-cutting machines. Rembrandt wanted to show how the divine babe was born into humble surroundings, and it was not his aim to depict Joseph as an up-to-date woodworker, any more than it was to show Mary as a fashionable lady of the court. For a broader spectrum of woodworking tools we might turn to the prints of Jan Joris Van Vlict, especially the Turner of about 1635 (Pl. 22b). It shows a craftsman operating a pole-lathe and turning out a baluster, with other lathe-turned objects littering the shop. Rembrandt instinctively shied away from a machine which, while not strictly anachronistic, would hardly have spied the imagination back to the little house in Nazareth. But turning nevertheless represents an important facet of both the material culture and the spatial imagination of the baroque period.

The goal of this essay is to arrive at a fuller understanding of baroque architectural theory, illuminated in an unexpected way by the theory of ornamental turning. It sketches the history of the tool from antiquity to the sixteenth century, and charts its rise to the top of the social scale in the two centuries that follow. It then turns to the writings of a French Minim friar, Charles Plumier, who published a treatise on the lathe and whose theories of the primacy of the creative imagination over rule and precedent are buttressed by an appeal to architecture. But if architecture provided turning with a model, the influence was reciprocal, and turning left its own subtle stamp on baroque architecture, particularly that of Borromini.

The lathe has a lengthy pedigree. It was over two thousand years old by the...
time of Rembrandt and Van Vliet. Along with the bow drill and the potter’s wheel, it
was one of the few complex tools known to antiquity. The first trace of working with
a lathe is a fragment of an Etruscan wooden bowl from Tarquinia, dated to 730–690
B.C. The earliest picture of a lathe comes from Hellenistic Egypt. It was a common
tool in ancient Rome, where it is mentioned by Vitruvius, Lucretius, Virgil and
Pliny. The Celts and Germans learned of it from the Romans. Charlemagne’s
Capitulare de villis mentions tornatores, and a room is set aside for tornari in the St
Gall plan. A thirteenth-century Parisian manuscript shows a pole-lathe rather like
Van Vliet’s being used to turn a wooden bowl. The throne in Cimabue’s great
Madonna in the Uffizi, with all its complex rings and beads, was doubtless made up
of pieces turned on the lathe, as are countless pulpits and screens in the mosques of
medieval Cairo, a city where turners can still be seen plying their trade on wood and
camel-bone.

Older lathes like the one illustrated by Van Vliet worked on the principle of
reciprocal motion. Power in one direction is supplied by stepping on a treadle,
while a bow or pole mounted on the ceiling supplies power in the opposite
direction. Ropes transfer the motion of the turner’s foot to a stick of rough wood,
called the ‘stuff’, which spins back and forth while the turner cuts it with a chisel
held against an immovable tool-rest. A great advance came when Leonardo da Vinci
introduced a flywheel that allowed the stuff to turn continuously in one direction,
thus eliminating the rhythms of cutting and rest that characterized earlier lathes.
Further advances are illustrated in the treatises by the French engineers Jacques
Besson and Salomon De Caus. The tendency of French engineering was to build
skills into the machine. Besson’s print, for example, shows how to turn out balusters
of a standard profile (Pl. 23a). A template bar with a wavy groove is mounted above
the spinning stuff, while a two-pronged chisel (shown hanging on the wall) was used
to transfer the exact shape of the groove to the piece of wood turned below it. The
print also shows two adjustable cams which can be set at an angle and (if braced by
fixed prongs, not shown in the print) send the stuff shuttling back and forth along
its axis while being worked. Another Besson print (Pl. 23b) shows the turner
holding a long cutting tool parallel to the axis of the stuff, which shuttles back and
forth guided by tilted cams. Strange oval and oblique shapes are the result. In fact
the oblique balusters that litter these sixteenth-century workshops seem to presage
the exotic theory of ‘architectura obliqua’ announced to the world in 1678 by
Caramuel de Lobkowitz (Pl. 27c).

Arnulf von Ullmann, Bildhauertechnik des spätmittelalters
und der Frührenaissance, Darmstadt 1984, pp. 55–61. The
great nineteenth-century compendium is Charles Holtz-
apfel, Turning and Mechanical Manipulation, 6 vols,
London 1846–81.

4 Vitruvius, De architectura, x, i, 6; Lucretius, De rerum
natura, iv, 360–61; Virgil, Georgics, ii, 449–50; Pliny,
Historia naturalis, xxxvi, 193. Vitruvius puts the lathe in
the category of tools so common they need no discus-
sion, like wagons, blacksmiths’ bellows and chariots.

5 Walter Horn and Ernest Born, The Plan of St. Gall, ii,
Berkeley 1979, p. 195 and the illustration of the plan on
p. 190.

6 Woodbury (as in n. 3), pp. 50–53.

7 Jacques Besson, Theatrum instrumentorum et mach-
inarum, with commentary by Francesco Beraldo, Lyons
1578 (or the more detailed Italian edition with
additional commentary by Giulio Paschali, Il teatro de
gl’instrumenti & machine, Lyons 1582), pls 7–10,
especially pls 7 and 8; and S. de Caus, Les raisons des
forces mouvantes, Frankfurt 1615, bk. i, prob. xxi, pl. 28.

8 See Appendix.
The tool in its mature form can be seen in an eighteenth-century French print (Pl. 23c). It shows a ceiling bow which is used to pull the treadle back up, but also a series of flywheels driven by a crank that would (when all the necessary cords were attached) turn the stuff in one direction continuously. Two nineteenth-century American lathes, one in a Shaker village and the other in a painting by Edgar Melville Ward, show much the same technology (Pls 26a, c). A treadle turns a crank and flywheel, which then in turn power a series of gears in the headstock that spin the stuff close to an adjustable tool-rest. About thirty chisels line these shops, the complex shapes of their blades are designed to produce an infinite number of elegant profiles. The many-lobed bedsteads and table supports of so much baroque furniture, ancestors of our pepper mills and piano legs, are typical products of the lathe, as are the twisting legs of so many baroque chairs and the spiral colonnettes of innumerable baroque altars and confessionals.

In many cities the turners clustered together on certain streets. In Rome they practised their trade along the Via dei Catinari, which is named for the catimaro or catimago, the turner who produced the large wooden bowls known as catini on the lathe. It is not, however, among the plebeian tornitori working around S. Carlo ai Catinari that we will find accounts of what it meant to work imaginatively on the lathe. Nor will we find this in the craftsman’s handbooks, like that written by the ingenious English printer and inventor Joseph Moxon. For articulate theory we must rather go to the ornamental turners, the clerics and noblemen scattered all over Europe who passed their leisure hours at the lathe, collected pieces of exquisite turnery in their museums, and wrote books about the ars tornandi.

Like the bagpipe, the lathe showed immense social mobility, rising from the ranks of craftsmen into the uppermost reaches of society, where its use became the pastime of noblemen and sovereigns, scientists and men of letters. Many princely houses insisted that their young males learn a manual trade, and the choice usually fell on turning. Famous master turners were called in to be the teachers and often the confidants of princes, and the result was a fashion of artistic turning, ‘Kunstdrechselri’, that took special root among the nobility of Germany. The Emperor Maximilian was given a richly decorated lathe as a present from the Tyrolean Diet in 1518; it still survives in Schloss Kreuzenstein near Vienna. Luther reportedly enjoyed working on the lathe. The Zick family of Nuremberg produced three generations of famous turners, including Peter Zick (1571–1629), who taught the

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10 Harry Rand kindly informed me of the existence of this painting, and fed me a steady stream of information on depictions of turners at their lathes in nineteenth-century realist painting from Léon Lhermitte to Thomas Eakins. Some older American lathes are shown in Henry C. Mercey, *Ancient Carpenters’ Tools*, Doylestown, Pa. 1929; 5th edn, 1975, pp. 214–28.
11 See Graziano Manni, *Mobili in Emilia*, Modena 1986, p. 267, fig. 181; p. 297, fig. 243; p. 299, fig. 246. Similar examples can be found in many collections of older Italian furniture.
14 Philippowich (as in n. 3), pp. 301–17 is the best study of German turnery, although he concedes practically no importance to the turnery of France. On pp. 315–17 he gives the most complete list of the sovereigns who practised turning.
16 Steinbrucher (as in n. 2), col. 380.
craft to the Emperor Rudolf II, and Lorenz Zick (1594–1666), who taught it to the Emperor Ferdinand in Vienna. Marcus Heiden produced many signed pieces of ivory turnery from 1625 to the 1640s that are preserved in Copenhagen and Florence, while Tobias Treffler practised the craft in Augsburg, and Jacob Zeller (1581–1620) brought it from Regensburg to Dresden. There the Dukes of Saxony collected masterpieces of turnery and practised the art themselves, beginning with Kurfürst August von Sachsen (1553–1586), and going on to Johann Georg I (1585–1656) and Johann Georg II (1613–1680). Carl, Landgrave of Hesse-Kassel from 1677 to 1750, inherited the princely passion for turning ivory and installed a Drehkammer on top of the Kunsthäus he opened in 1709, where he passed his leisure hours.

Turning spread from Germany into the outlying lands of Europe. Peter the Great (1672–1725) loved turning and had the first great monograph on turnery by Plumier translated into Russian; drawings apparently record some of his best creations, though most of the objects themselves were lost in a fire in 1747. In Denmark turning was a hobby of generations of kings. The royal turner held a position of trust, and entrance to the turning room was gained only with royal permission. So it became the favourite storage place for precious objects of all sorts, including art, jewels and ceremonial arms. The Drehzimmer metamorphosed into the Kunsthäuser.

The daughter of George II of England, Queen Louise of Denmark, practised turning until her death in 1751, and so did the Danish kings Christian VI and Frederick V; in 1754 Queen Juliane-Marie produced a masterpiece in the form of a tempietto with six columns resting on six ivory balls.

Turning took root in Italy in the early Renaissance. Duke Alfonso d’Este of Ferrara (1457–1534) was a famous turner. Leonardo designed a lathe which worked with continuous motion and was supposedly the first to turn oval-shaped forms. His legacy was continued in late sixteenth-century Milan by Giovanni Ambrogio Maggiore, who as early as 1582 invented the art of turning one ivory ball inside another to form what was known, in the international language of turning, as the Contrefaikugel (Pl. 24c). Maggiore brought the art of the Contrefaikugel, as well as the secret of turning oval shapes, from Milan to Munich, where he served Duke Wilhelm V and his son Maximilian. His pieces entered collections in Turin and

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20 Oleg Neverov, ‘His Majesty’s Cabinet’ and Peter I’s Kunsthäuser, in Impy and MacGregor (as in n. 19), p. 57. Kirsten Aschengreen-Piacenti, ‘La collezione medicea di avori torniti’, Antichità vive, ii, 1, 1965, p. 24, fig. 11, illustrates a piece in Florence traditionally attributed to Peter the Great. For the Russian edition of Plumier see n. 39 below.
21 Bente Gudestrup, ‘From the Royal Kunsthäuser to the Modern Museums of Copenhagen’, in Impy and MacGregor (as in n. 19), p. 128.
22 Philippovich (as in n. 3), p. 316.
23 Philippovich (as in n. 3), p. 316.
24 Dorothea Diemer, ‘Giovanni Ambrogio Maggiore und die Anfänge der Kunsttischerei um 1570’, Jahrbuch des Zentralinstituts für Kunstgeschichte (München), i, 1985, pp. 295–342. On Leonardo’s practice Diemer cites the Codex Atlanticus, fol. 121v, with the note ‘fa fare il tornio ove al telescio; see also Lomazzo’s Idea del tempio della pittura, ed. R. Klein, i, Florence 1974, p. 49. My thanks to Dr Aschengreen-Piacenti for the reference to this important article.
Madrid, and his famous *Contrfaithugel* in ebony and ivory containing portraits of the family of the Duke of Bavaria was placed in the Tribuna of the Uffizi by Francesco I de’ Medici. When John Evelyn visited the grand-ducal collections in Florence in 1644, he saw in the Palazzo Vecchio ‘such rare tourneries in Ivory, as are not to be describ’d for their curiosity.’ By the 1670s foreign artists like Filippo Sengher would settle in Florence and teach the *ars tornandi* to Grand Duke Cosimo III and Prince Ferdinando de’ Medici. Carlo Emanuele II of Savoy loved to turn, and a walnut lathe built for him by the cabinetmaker Giuseppe Brunatti in 1736 still survives in Turin.

Northern turners apparently made their home in Rome as well. In his *Tesoro Messicano*, published in 1651, the doctor Joannes Faber mentions a visit in Rome to the Swedish turner Osvaldo Nerlingero, ‘Tornator artificiosissimus’, who showed him a little hollowed-out pea into which up to 1200 microscopic beads could be inserted. Cardinal Flavio Chigi had many fine specimens of virtuoso turning among the hundreds of exotica strewn all over his villa near the Quattro Fontane.

While it was rising to the top of the social scale, turnery also filtered down into the collections and cabinets of most European virtuosi. Samuel Quiccheberg’s guide to encyclopedic collecting of 1565 included a turning room: ‘Tornatilis supellectilis, et instrumentorum tornatoriurnque officina.’ Pierre Borel’s encyclopedic cabinet of curiosities included masterpieces of lathe work, like ‘goblets as thin as paper.’ One of the most splendid collections was that of the great Milanese virtuoso, Manfredo Settala (1600–1680). In his laboratory near S. Nazarro he ground burning mirrors, made watches and precision instruments, and turned ivory on the lathe. He chose to have his portrait painted holding a delicate piece of turnery (Pl. 24a). His funeral catafalque recorded the fact that he taught the art to noblemen like the Archduke John of Austria and Don Vincenzo Gonzaga.

And Manfredo’s famous museum contained many pieces turned by himself or given

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30. Samuel Quiccheberg, *Inscriptiones vel tituli theatris amplissimae, complectentia versus universitatis singulas materias et imaginis eximias*, Munich 1565 (unpaginated), under the heading ‘Musea et officinae, ac reconditoria, qualia ad sapientiae & incunabuli artificijs supellectilem ...
to him by other passionate turners. One was a ‘scala chioccia con molta bizzaria di arte lavorata’ inside an ivory column two palms high, with ivory figures ascending and descending the steps like Jacob’s ladder, with a grotto and mountain on the top where there was a horse killing a dragon, ‘Opera di molto tempo, e di non minor patienza.’ There were little ivory pyxes as well, and ‘opere minute lavorate al tornio.’ When visitors to the museum protested that Manfredo could never have turned such intricate pieces himself, he stepped up to the lathe and turned out more to demonstrate that ‘even in Lombardy men had the patience of Germans.’

If turning was employed to produce miniature specimens of sculpture and architecture, it was also used to produce anatomical models. The English virtuoso John Bargrave counted in his collection a model of the human eye that could be dismantled into fourteen pieces, made in Padua on a doctor’s instructions by a German artist ‘by way of turnery in ivory and horn.’ The combination of Italian anatomy and German craftsmanship must have been stunning, and the model of the eye would long remain a challenge to the high skill of the northern turner. An illustration of such an artificial eye by the Nuremberg turner Stephan Zick appeared in 1680, and Johann Martin Teuber gave precise instructions on how to make one in his treatise of 1740, using ivory, light and dark horn, clear glass for the lens and the vitreous humour, and vellum for the muscles (Pl. 28a). The eye could be dismantled into its most minute components. Complete with lids and lashes, and standing on a tall sceptre-like base that was itself turned on the lathe, the Kunst-Aug lent its slightly eerie presence to many a cabinet of curiosities. But it also must have been an invaluable aid to restless dissectors of the eye like Nicolas-Claude Fabri de Peiresc and Christopher Wren.

However, if we want to penetrate into the mind of the turner at work, we must move on from German craftsmen and Italian collectors to the articulate turners of southern France. Nicolas Grollier de Serviere (1596–1689) was among the most


33 John Bargrave, *The Nobilitie & Gentry*, ed. J. C. Robertson, London 1867, p. 126. Bargrave says, ‘I bought this eye at Venice of a High Dutch turner, and, for the proof of it, I went a double share in two anatomies, of a man’s body and a woman’s, chiefly for this eye’s sake, and it was found to be exact.’ I first encountered Bargrave’s book thanks to a reference from Richard John.

34 Philippowicz (as in n. 3), p. 253, fig. 189.

35 Johann Martin Teuber, *Vollständiger Unterricht von der gemeinen und hörbaren Dreh-Kunst*, Regensburg 1740, pp. 58–62 and plate viii of part i. The frontispiece of the book illustrates three generations of Teubers of Regensburg who achieved renown as turners, along with some of their masterpieces. There is also a recipe for a Kunst-Ohr on pp. 42–45. An eye of 1730 from Johann Gabr. Doppelmayr is reproduced in Aschengreen-Piacenti 1963 (as in n. 20), p. 22, fig. 9.

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celebrated ornamental turners of the century, and one of the few who reveals something of the mentality of the aristocrat at the lathe.\(^{37}\) He was born in Lyons and followed a military career that brought him to Flanders, Germany, Italy and Constantinople; he was at the White Mountain when the Catholic cause triumphed in Bohemia, and at Casale when the young Captain Mazzarini galloped across the field bearing tidings of peace. A talented military engineer, he was expert at deploying movable bridges on the battlefield. When he retired to his home in Lyons he built a series of fantastic machines and displayed them in a cabinet famous enough to attract all the virtuosi and to merit visits from Louis XIV. It featured water-pumps and Archimedean screws, siege ladders and engines, models of floating bridges, odometers with reducing gears, clocks regulated by the motion of balls down inclined planes or spiral channels, wheelchairs and reading machines, machines to draw the profile of a landscape and to turn plan into perspective, and of course lathes and countless pieces of lathe-work in ivory and wood.

When Grollier’s son published a book on his father’s cabinet he explained the qualities connoisseurs looked for in ornamental turnery. One was extreme delicacy of workmanship: ivory hollowed out in fantastic spirals, or reduced to elfin thinness, or shaped into concentric hollow globes (Pls 28b, 25b). They stun the spectator who cannot believe they are carved from a single piece. Since the lathe operates by turning the stuff about its axis, its normal products tend to look like balusters or bedpoles, elaborate in profile but simple in conception. So connoisseurs, in their search for the difficult and the exceptional, looked for pieces turned in eccentric orbits around many axes. Among such pièces excentriques were ivory globes inside of which one might find a well-turned urn, a fleur-de-lys, or many-pointed stars. The beauty of the piece came from the difficulty one imagines the turner to have had to make it out of a single ball of ivory. The same logic applies to pieces cut hors du rond, such as vases with bizarre scalloped shapes that seem to deny the circular motion of the lathe (Pl. 25a). Turnery is an art which delights in straining the limits of tool credibility. Extremely delicate and cut with machine-like precision, one cannot believe these pieces were carved by hand, but it baffles the imagination to conceive how they might be turned on even the most complicated lathes.\(^{38}\) Many ivory pieces tended to be tall and precariously thin, like the circular steps that are attached to each other by tiny stems, looking like a pile of coins held together by bits of toothpicks, but all turned from a single tusk (Pl. 25a). There is a tower-making mentality, in which the elements near the top of the piece are miniature variants of the elements occuring further down. There is a preference for spiralling forms, miniature towers of Babel with complex encircling ramps. The snake is a frequent decoration, coiling in long sinuous spirals (Pl. 25c). Mouldings are

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\(^{38}\) See Moxon (as in n. 12), p. 227: ‘Some Turners to shew their Dexterity in Turning, and make others that know not the way how it is done admire at their Skill, turn long and slender sprigs of Ivory as small as an Hayskall, and perhaps a Foot or more long…’; and also the memoir by M. de la Condamine, ‘Recherches sur le Tour’ (8 July 1733, in Plumer, as in n. 9, pp. 192ff.): ‘Le Tour a été porté depuis un siècle, & sur tout de nos jours, à une grande perfection. Nous avons des Ouvrages qu’on a peine à concevoir que le Tour puisse exécuter, mais qu’on imagine encore moins qui ayent pu se faire sans le secours du Tour.’
multiplied beyond all limit, and deeply undercut to bring out all the transparency of ivory. Some pieces pile up clustered forms: a many-pointed star inside a globe, on top of six cubes inside one another, on top of six concentric spheres (Pl. 24b). The Keplerian universe, one feels, has been reduced to a play of miniature forms.

Conflicting perceptions like these brought on a frisson of delight in the connoisseur, followed by the pleasure of savouring the unflinching bon goût of the artist who turned such miracles: ‘On y voit régner les regles d’une architecture exquise, qui prévient à la première vuè de l’ouvrage, & qui se soutient parfaitement lorsqu’on l’examine en détail.’ 30 A good piece of ornamental turnery was valid at first sight and also after long scrutiny.

Grollier died in 1689, but his memory was tended by his son, the younger Grollier de Serviere, Grand-Prieur de l’Abbaye de Savigny. Among the many visitors he showed around his father’s cabinet was a young Minim friar from Marseilles, Charles Plumier, who had studied turnings with his father and who would go on to write the first detailed history of turnery. His L’art de tourner en perfection was first published in Lyons in 1701 and republished in Paris in 1749. 40 Plumier (1646–1704) would eventually turn into one of the greatest botanists of his age, but in his youth he was hypnotized by the lathe. At the age of sixteen (1662) he went to Toulouse to study turning under the expert tutelage of Père Emanuel Maignan (1601–76), the great Minim mathematician and expert turner. Maignan had spent the years 1643–50 in Rome at the convent of the Trinità ai Monti, where he had set up a solar meridian gallery and decorated one of the corridors with an anamorphic perspective of S. Francesco di Paola. 41 Apparently he had practised turning there as well, since when Plumier himself moved to Rome he found that the convent was about to dispose of a complete set of joiner’s tools. He convinced the Minim Corrector to keep them, and in return set about making the choir stalls in the Trinità ai Monti. 42

Plumier tried to copy every type of lathe he saw, and he was in touch with turners all over Europe. His preface is a Who’s Who of the world of ornamental

30 Grollier de Serviere (as in n. 37), p. 9. See also Plumier (as in n. 9), pp. 1790: ‘La Planche LXV, représente un sceptre que l’on a été obligé de couper en deux parties à cause de sa trop grande longueur. Ce sceptre est de l’invention de l’Auteur qui s’est plû à y rassembler tout ce qu’il peut imaginer de plus difficile & de plus délicat dans le Tour; pour faire voir la variété des différents Ouvrages qui peuvent s’exécuter par le moyen de ce bel Art.’

40 On Plumier’s career see the excellent study by P. S. Whitmore, The Order of Minims in Seventeenth-Century France, The Hague 1967, pp. 187–98. The Lyons edition of 1701 was dedicated to Michel Bégon, on whose collection see Schnapper (as in n. 37), pp. 286–89. Whitmore mentions a Russian edition of L’art de tourner prepared under the direction of Peter the Great; Steinbrucher (as in n. 2), col. 390, cites a German translation of 1776; a facsimile edition was published by Jacques Lazet and Philippe Daviaud, Paris Librairie des Arts et Métiers, Nogent le Roi 1765. According to Whitmore the original illustrations to the book are in Paris, Arsenal MS 3078. As Whitmore notes, many of Plumier’s plates were borrowed without acknowledgement in the extensive article ‘Tourner’ in the Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers, Recueil de planches sur les sciences, les arts libéraux, et les arts mécaniques, x, 1776, pls 175–261. See also Abell, Leggat and Ogden (as in n. 3), pp. 59–61, where it is suggested that Plumier completed the MS before his first voyage to the Antilles in 1689.

42 Whitmore (as in n. 40), p. 185, drawing on the late eighteenth-century MS possibly by P. Charles Martin in the convent archives, Histoire du Couvent royal des Minimes français de la trés-sainte Trinité sur le Mont Pincio, à Rome, Book iii, pp. 170ff. In Whitmore’s judgment, ‘the design is of admirable simplicity and good taste, bespeaking a good craftsman rather than a flamboyant designer.’ Luigi Salerno noted that the choir-stalls were attributed to Plumier, but feels that the originals are now lost (Piazza di Spagna, Naples 1967, pp. 38–40, citing part i, p. 41 of the Martin MS).
turnery, particularly in its French manifestations. In Paris the informants he names are M. de Clotomont, M. l’Abbé Forcet de la Guiche, and M. de Maubois, ‘tourneur pour le Roi dans le Louvre.’\textsuperscript{43} He has special esteem for the turnery of Provence. From him we learn that the Cabinet of the Grand Duke of Tuscany was full of pieces by the great artist Faucher Poitevin, a fellow citizen of Marseilles, whom Plumier describes as a ‘Tourneur incomparable, ne se trouvant pas dans le monde son égal pour la beauté & la délicatesse de ses ouvrages, qui sont en divers endroits l’ornement des Cabinets des Princes, & sont considérés comme inimitables.’\textsuperscript{44} The Oratorian priest Claude Chapuis and a man named Maroti were other famous turners from Marseilles. Aside from Grollier de Serviere,\textsuperscript{45} Lyons could boast of M. l’Abbé de Perichon, Prevôt de S. Salvador. And Toulouse had produced the incomparable Maignan.

Under the influence of Provencal botanists at the Trinité ai Monti, in particular Philippe Sergeant and Pierre-Joseph Garidel, and also of the Italian botanist Paolo Bocccone, Plumier’s interests gradually turned to the study of plants. Eventually he was to make three scientific expeditions to the Americas between 1689 and 1697, and die in 1704 while setting out for a fourth. His botanical work is a landmark in the study of American flora. He is the man who named the begonia, the magnolia and the fuchsia after botanists he esteemed.\textsuperscript{46} He is also the man who, in a chance remark, lighted up baroque architectural theory with a floodlight that shines directly on Borromini. For this we must turn back to his book on the lathe and look at the aesthetic structure surrounding ornamental turnery.

L’art de tourner en perfection sets out to give the full intellectual pedigree of turnery. From it we learn that the groom in the Song of Songs had limbs ‘as though turned on a lathe’, that Solomon’s architect Hiram knew of the machine, and that Phoenician turners were called to work on the Temple of Solomon. The Romans turned flutes, water-organ pipes, and especially ivory bed legs on the lathe. In modern times, working on the lathe is the ideal pastime for all men of quality: for noblemen to while away the rainy winters; for beneficed ecclesiastics to flee idleness; for the solitary to have an honest occupation; not to mention for watchmakers, woodworkers, and goldsmiths.\textsuperscript{47}

\textsuperscript{43} According to Whitmore (as in n. 40), p. 198, when Plumier’s work was reviewed favourably in the Journal de Trévoux (May 1702, pp. 3–16; September 1702, pp. 83–90) he was praised for acknowledging Maubois, whose work ranged from turning the spiral columns in the church of the Invalides to producing bronze vases for the gardens at the Château de Choisy, and making the screws for the balancier de Siule and the balancier des médaillées.

\textsuperscript{44} Plumier (as in n. 9), p. xi.

\textsuperscript{45} Plumier (as in n. 9), p. 142, where it is said that most of the profiles on pl. xvi are the inventions of Grollier de Serviere.

\textsuperscript{46} Charles Plumier, Nova plantarum americanarum genera, Paris 1705. Some other names that have not taken such firm root in the language are Caesalpina (for Andrea Caesalpino of Arezzo), Sloana (for Hans Sloane, founder of the British Museum), Bocconia (for Paolo Bocccone), Malpighia (for Marcello Malpighi of Bologna), Rondeletia (for Guillaume Rondelet of Montpellier), Columna (for Fabio Colonna), Peireskia (for Peiresc), Petiveria (for James Petiver of London), and Pitonia (for Joseph Pitton de Tournefort). See also his Traité des jougères de l’Amérique, Paris 1705. Whitmore (as in n. 40, p. 197) sums up Plumier’s scientific achievement thus: ‘Had he lived to see his voluminous work through the press, he would have been regarded as an earlier Buffon, as an important forerunner of the encyclopaedists. Even so, his influence on the whole school of descriptive botany, and even on Linnaeus, is profound; he transformed the herbal into the detailed and well-illustrated text-book.’

\textsuperscript{47} Even at the end of the eighteenth century the lathe was offering the same kind of therapy. Compare E. L. Bergeron [Louis George Salvet], Manuel du tourneur, I, Paris 1792–96, preface: ‘Entre une infinité d’exercices, que la Médecine & la raison prescrivent à l’homme pour réparer, par des mouvements modérés, l’épuisement que le manque d’occupations, les travaux d’esprit, une longue convalescence, les chagrins même, peuvent
JOSEPH CONNORS

In a chapter on profiles Plumier crosses over from turnery into architecture. To do a satisfying profile on the lathe it takes an instinctive bon goût which is difficult to codify into simple rules. The novice turner will want to use geometrical drawings, and for the simple craftsman an elegant profile can be built into the machine, as in the template-bar shown in Besson’s print. But the master turner will work without drawings, designing as he cuts. L'idée and génie count for more than rules of thumb. So too in architecture buildings built by eye, following the imaginings of l'idée ou le seul caprice, give more satisfaction than those built by rule. Plumier calls on three great architects to prove his point: Puget, Michelangelo and Borromini. 48

Pierre Puget, fellow native of Marseilles, ‘grand Peintre, grand Sculpteur, & ensemble grand Architect’, once had a conversation with Plumier, in which the Minim showed the sculptor a book of architecture that he had drawn after Palladio and Vignola. 49 Puget complimented Plumier politely on what he had drawn, but then went on to denigrate the rules of these authors and to recommend that the architect form designs adapted to the specific sites and circumstances of each commission. According to Puget it was exclusively the building’s quality to please (‘l’agrément’) that made the laws and rules of architecture, not drawings and not books. How often did exquisite drawings and models result in unsatisfactory buildings that had to be rebuilt. The quality to please was what counted, from buildings as a whole down to their most minute part.

Puget obviously converted Plumier to the idea that individual genius should dominate over rules. Thereafter Plumier never ceased to believe in the importance

48 Plumier (as in n. 9), part iv, ch. ii (‘Des Profils et Moulures’), pp. 138–39, accompanied by plate xvi: ‘Il ne suffit pas pour devenir habile Tourneur, de savoir à fond les machines & de bien manier les outils du Tour; mais il est encore nécessaire de bien entendre le profil pour donner le bon goût aux ouvrages. J’appelle le profil un simple contour; & le bon goût, cet agrément à la vie qui d’abord satisfait l’esprit par le seul port & aspect de l’ouvrage. Véritablement il est bien difficile de pouvoir expliquer ce bon goût, & d’en établir des règles précises, puisqu’il dépend plutôt de l’idée & du génie des gens que d’une méthode certaine. L’œil seul en doit prescrire les règles & les lois, de même que dans l’art de peindre & dans l’architecture, où toutes les règles qu’on a pu donner n’ont jamais su former des ouvrages aussi agréables que ceux que bien souvent la seule idée ou le seul caprice imagine; comme peuvent témoigner plusieurs beaux ouvrages de quelques grands hommes. Notre illustre Pierre Puget de Marseille, grand Peintre, grand Sculpteur, & ensemble grand Architecte, voyant un Livre d’Architecture que j’avoir dessiné d’après le Palladio & le Vignole, me témoigna grand plaisir de le voir, mais il m’avoir en même temps que toutes les règles de ces Auteurs étoient fort peu nécessaires, & qu’il fallloit que l’Architecte format lui-même des dessins convenables aux lieux & aux situations où l’on devoir construire; & que c’étroit le seul agrément de l’ouvrage qui faisoit les lois & les règles d’une bonne architecture, & non pas les dessins ni les livres. En effet combien de grands & beaux édifices n’avaient pas été étoit de rebâti, faute de ce bel agrément lorsqu’ils ont été achevés, quoique très beaux sur les dessins & sur les modèles. Ce n’est pas seulement pour un corps entier d’un ouvrage où l’agrément doit servir de règle; mais c’est aussi pour chaque membre même jusque aux moindres parties, puisque Monsieur d’Aviller très savant dans l’Architecture, ayant [p. 139] donné dans le grand Ouvrage qu’il en a composé Tome I. pag. 327. [sic, actually p. 321] des proportions & règles aux balustres, il avoit pourtant que la grace de leur galbe dépend du bon goût du dessin. C’etoit aussi le sentiment du grand & célèbre Michel-Ange, comme j’appris étant à Rome par le Sieur Dominique Barriere, Français de nation, l’un des plus habiles Dessinateurs & Graveurs de Rome. Je le entendis dire bien des fois avoir vu un Manuscris de la propre main de Michel-Ange entre les mains de ce bizarre Architecte [1701 edn: il Borromino] le Cavalier Borromini, contenant plusieurs belles leçons d’architecture, où il concluoit pourtant que les meilleures étoient celles du génie de l’Architecte même.’

of imagination and innovation. He maintained that in the history of architecture the most interesting ideas have often come about from pure chance, as when Callimachus invented the Corinthian capital, or when another ancient architect invented the spiral column after seeing vines growing around trees. The author of the *Nova plantarum americanarum genera* instinctively welcomed a natural theory of architecture.

To reinforce his arguments in favour of *génie*, Plumier goes next to Michelangelo, though he only gets to him indirectly, after making a daring foray into the enemy camp. He cites Augustin Charles d’Aviler’s *Cours d’architecture*, a book that is a paean to rule. For d’Aviler, those who depart from rule lose their reputation, whatever their genius. The orders, mouldings and other parts of architecture are like the letters of the alphabet; when combined they can make an infinity of words, but only following rules, especially rules based on geometry. D’Aviler’s whole *oeuvre* is drenched in contempt for the ‘nouveaux inventeurs’ who depart from the antique and introduce licence into their designs, following a sterile and capricious genius. His *Cours* set out to stop the licence characteristic of Italian and especially Roman architecture from invading France. Gothicisms like ‘Cartouches, Frontons brisés, colonnes nichées & autres extravagances’ were perpetuated by Borromini, Cortona, Rainaldi and other despisers of the antique, men whose painting and whose sculpture were as degenerate as their architecture. Nevertheless d’Aviler did allow one man to follow his own genius in defiance of rules, namely Michelangelo, the only innovator who somehow managed ‘de sortir des règles ordinaires sans s’égarder.’

And so Michelangelo is the next witness Plumier himself calls in to testify in favour of *génie* over rule. He cites a document unknown to us from any other source:

This [i.e., the superiority of invention over rule] was also the sentiment of the grand and celebrated Michelangelo, as I learned in Rome from Sieur Dominique Barrière, a Frenchman and one of the most talented draftsmen and engravers of the city. Often I heard him say that he had many times seen a manuscript penned by Michelangelo’s own hand, in the hands of the bizarre architect Cavaliere Borromini, containing many beautiful lessons in architecture, where Michelangelo concluded nevertheless that the best lessons were those of the architect’s own genius.

This is an amazing assertion, that Borromini owned a manuscript by Michelangelo on the rules of architecture. The prevailing opinion is that ‘Michelangelo wrote next to nothing about his own art.’ Condive mentions only a treatise on

50 Plumer (as in n. 9), p. 164. He goes on to praise the spiral columns of Bernini’s baldachin as well as their ancient prototypes, and then makes the connection with turnery: ‘On peut voir dans divers endroits une infinité de ces colonnes torses, & on remarque par tout qu’elles enrichissent beaucoup les ouvrages qu’elles accompagnent, non seulement ceux d’Architecture, mais encore du Tour, puisqu’il y a fort peu de Tourneurs qui ne se piquent de les bien entendre, & qu’ils ornent leurs plus beaux ouvrages de quelque pièce en colonne torse, comme j’ai vu en plusieurs cabinets.’


52 D’Aviler (as in n. 51), unpaginated preface, and pp. 261–93. The quotation is from p. 270, dealing with the Porta Pia.

53 See n. 48 above. Bizarre is used in the sense of imaginative, and in the next sentence Plumier includes Borromini along with Poget and Michelangelo as ‘ces trois Grands Hommes.’

painting based on Michelangelo's extensive research in anatomy, but adds that he gave up the project at the age of 78. In the eighteenth century, when Giovanni Bottari asked his friend Senator Filippo Buonarroti if he knew of any memorie on how Michelangelo became an architect, he was told there were none in the family house. There are a few autograph letters, sometimes tinged with irony, and there are possibly echoes of the master's ideas in works by Vincenzo Danti and Francisco de Hollanda. These, along with the reminiscences of Condovi, Vasari and Cellini, are all we have of Michelangelo's theory of architecture.

And yet Plumier's sources are trustworthy, and certainly lead us back to Borromini even if the jump from there to Michelangelo remains more hazardous. Plumier's source, the printmaker Domenico Barrière (c. 1615–1678), was close to Borromini. He provided the etchings of Borromini's Oratory for the 1658 edition of Martinelli's Roma ricercata based on drawings supplied by the architect. When Borromini conceived of the project to publish his work around 1659–60, Barrière again did the plates, which remained in the possession of Borromini's nephew and were finally published in the Opus Architectonicum of 1720–25. In addition, Barrière and Plumier were both natives of Marseilles, and Plumier seems to have gone out of his way to look up his concitoyens in Rome. Plumier's own teacher, Père Emanuel Maignan, had worked on the Palazzo Spada; but of course so did Borromini, and Bernardino Spada was the Cardinal-protector of the Minims at the Trinità ai Monti. Plumier moved in the same small world as the great architect and his printmaker had.

But the manuscript is still puzzling. The survival of an authentic and otherwise unknown Michelangelo manuscript may be improbable, but it is equally difficult to imagine that Borromini was taken in by a total fake. He was a distinguished student of Michelangelo's work. He probably studied the drawings housed in the Casa Buonarroti in Florence, and his early plan for S. Carlino seems to derive from one of them. He could describe where Michelangelo left off in the Sforza Chapel and where Tiberio Calcagni took over. He studied the original model for S. Giovanni

see also the same author's Michelangelo and the Language of Art, Princeton 1981, especially ch. viii, pp. 141–63. Commenting on a Michelangelo letter, James Ackerman says: 'The scar of a letter cannot be taken as evidence of a theory of architecture; in fact, it expresses an attitude which in the Renaissance might have been called anti-theoretical' (The Architecture of Michelangelo, i, London 1961–64, p. 2). Throughout my discussion of Michelangelo I am indebted to Ackerman's and to Summers's work. However, to my knowledge the Plumier passage has not been cited in the literature on Michelangelo.


57 See above, n. 41.

58 Albertina 171 (S. Carlino) seems to show a knowledge of Casa Buonarroti 109A (a quatrefoil plan for a centralized building in the period of the Sforza Chapel). See L. Steinberg, Borromini's San Carlo Alle Quattro Fontane: A Study in Multiple Form and Architectural Symbolism, New York and London 1977, pp. 38 and 158. Although Cosimo de' Medici was anxious to secure Michelangelo's drawings after his death, the artist's nephew Leonardo Buonarroti kept the major part of the inheritance from his grasp. Leonardo's son Michelangelo Buonarroti the Younger (1568–1647) transformed the family property on the Via Gibellina in order to house the collection, and in addition purchased some Michelangelo drawings from Bernardo Buontalenti. See Alison Wright, The 'Fortuna' of the Drawings, in Michael Hirst, ed., Michelangelo Draftsman, Milan 1988, pp. 159–64.

59 See F. Martinelli's MS guidebook of 1660–63, Roma ornato dall'architettura, fattura e scolatura, published by C. D'Onofrio as Roma nel seicento, Florence 1909, p. 104
dei Fiorentini, and felt himself to be Michelangelo’s successor in that project, finishing the apse and struggling like the master had ‘to found so great a church in so terrible a river.’ When he looked at an Assumption by Daniele da Volterra in the Trinità ai Monti, he knew that the apostles’ heads were portraits of friends of Michelangelo and could name them. Whatever the source of the manuscript with the ‘plusieurs belles leçons d’architecture’, it must have been one of Borromini’s most treasured possessions.

The manuscript confronted the paradox of teaching originality. Even after its leçons had been worked through, the student was still told to follow his own génie. This is exactly what we might have expected Michelangelo to say. Conditi has Michelangelo say that there was room to improve over the antique, and Vasari has him take his distance from the ornament prescribed by Vitruvius. In the Medici Chapel Vasari says that he used a more varied and original order than any previous master, and broke the bonds and chains within which artists had previously worked. Later, writers, such as Lomazzo in 1584, Bocchi in 1591, and Cigoli in 1612 continue to see Michelangelo as the champion of originality in architecture.

If what Michelangelo stood for was much admired, it was also much resisted. Vasari himself is wary of Michelangelo’s licence, which might encourage others to work more alla grottesca than according to reason or rule. Pirro Ligorio opened fire on Michelangelo right after his death, criticizing the indecorum of Porta Pia, where the ordini rotti were more appropriate for tombs than for temples of the living God. Cardinal Paleotti fulminated against all hint of the grotesque; Daniele Barbaro joined Vitruvius in his condemnation of fantasy, grotteschi, and innovation.

Bernardino Baldi, the mathematician and historian from Urbino, sketched the situation as he saw it in 1587: tasteful classicism stood somewhere in between the barbarism of the gothic and the ruleless caprice of modern architecture, which Michelangelo had led too far astray.

(MS p. 135), Borromini's marginal note on the Sforza Chapel: 'La volta dopo la morte del Bonarota da Tiberio Calcagno suo giovane ma non inteso e si vede non corrispondere alla bizzarria del resto.'

60 Giorgio Vasari, Le vite de’ più eccellenti pittori, scultori ed architetti, ed. G. Milanesi, Florence 1878–86, v. p. 453. Michelangelo's model survived until 1720 in the consolato dei Fiorentini, and there was also some sort of 'disegno originale' there until 1742 (E. Rufini, S. Giovanni de' Fiorentini, Rome 1957, pp. 15f). Borromini wrote marginal comments in Martinelli's manuscript on the model, but unfortunately they are illegible (Martinelli; see D’Onofrio, as in n. 59, p. 59, MS p. 74).

61 Martinelli (D’Onofrio, as in n. 59, p. 182, MS p. 237) tells of a visit to the Trinità ai Monti with Borromini and Francesco Mocchi, and of the comments on Daniele's painting in the Della Rovere Chapel: 'celeberrissimo l'uno Architetto, e l’altro Scultore del nostro secolo, quali mandavano le teste degli Apostoli per ritratti d’uomini illustri nella pittura e scultura tutti amici del Buonarota, e di lui proprio.'

62 Ascanio Conditi, Vite di Michelagnolo Buonarroti, Milan 1964, p. 76: 'cosa [i.e., the facade of Julius III's palace] ... insistita e nuova, non obbligata a maniera o legge alcuna antica ove moderna. Il che ha fatto anco in molte altre sue cose in Firenze ed in Roma, mostrando l’architettura non essere stata cosi dalli passati assolutamente trattata, che non sia luogo a nuova invenzione non men vaga e men bella'; Vasari (as in n. 60), vi, p. 233; Ackerman (as in n. 54), ii, p. 144; and Summers (as in n. 54), pp. 146ff.


65 Bernardino Baldi, Memorie concernenti la città di Urbino, Rome 1724, pp. 64f. (1587 for the first edition, according to P. Rotondi, Il Palazzo Ducale di Urbino, i, Urbino 1950, pp. 403f, n. 3).
of the seventeenth century, praise of Michelangelo becomes rarer and rarer, and the heavy frontal attacks begin, like that of Fréart de Chambray on ‘l’impertinence de son esprit en ce qui concerne l’Invention.’ 66 Three years later it was Fréart’s brother, Chantelou, who suggested to Bernini that Michelangelo was the man who had introduced libertinage into architecture. 67

This fear of excessive originality is poignantly expressed in a passage of Pietro Testa’s notes, where he imagines a gathering of artists on Mount Parnassus. Naturally Michelangelo is among them, and he is described as trying to show a group of architects how one can ‘enrich the mantle of Architecture’ without offending the great Vitruvius and the ancients. But the lesson is a failure. He is so upset that younger minds might go out and create monsters, that in the end it seems better to leave Lady Architecture with her ancient dress, however worn and tattered, so that at least she can be seen in her noble proportions. In Testa’s mind, young architects would do well to keep their distance from the old master and all that he stands for. 68

In this atmosphere of timid caution Borromini saw Michelangelo as a beacon of courage, and must have been delighted by what he found in the manuscript. His own theory of design was based on a subtle alchemy of learning transformed by imagination. He knew his Vitruvius, as well as all the reasons why people like Peruzzi thought Vitruvius fell short of capturing the true variety and beauty of ancient architecture. 69 All the texts that are close to Borromini put the accent equally on his great knowledge of precedent and his freedom in departing from it. 70 A copious, fertile, imaginative mind transforming a vast range of learning: this seems to be the way Borromini and those close to him thought of his achievement. 71 He did not share Testa’s timidity about Michelangelo. To a world suspicious of innovation (‘molto che non sanno inventare’) he hurled this challenge:

And I for one would never have entered this profession only to become a copyist, although I know that in inventing new things the fruit of one’s labour will come only late, just as it

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69 Summers (as in n. 54), p. 191.

70 See the remarks of the procurator of S. Carlo alle Quattro Fontane: ‘disegno così extraorainario, che mai si trova havere copiata ne mendicata cosa alcuna di architetto nessuno: Ma si bene fondata sopra lo antich, et conforme quello che li Valentinissimi architetti lasciaron scritti’ (quoted by Juan de San Bonaventura, Relazione, in O. Pollak, Die Kunsttätigkeit unter Urban VIII., i, Vienna 1928–31, p. 40, reg. 295, with minor corrections here).

71 See the anonymous French guidebook of 1675 in the Avery Library, Columbia University (Description de Rome moderne, pp. 1430), which is somewhat cool to Borromini but still appreciative of his achievement. In describing the Casa dei Filippini it says: ‘sa manière est toute nouvelle et, sans se restreindre à n’imiter que l’antiquité et aussi sans trop s’en éloigner, il y change et y ajoute ce qui lui plaît. Il est surtout en maitre des faces plates et dans tout ce qu’on voit de lui on ne trouve jamais une ligne de droit … tout paroi cornue en l’ussage. On se plairait volontiers de cette liberté; cependant il y a je ne sais quel accordement et ce que d’autres ne pouvoient imiter sans degener(er) dans le chétif et le mesquin, il y a le talent qu’il ne laisse pas d’y avoir du grand dans ce qu’il fait. Certaines inflexions qu’il donne qui rendroient l’ouvrage d’un autre ou bizarre ou désagreable relevent le sien en sorte que tout ce qui vient de lui paroit fort estudi et une production d’un grand travail. C’estoit cette envie qu’il avoit de donner toujours de nouvelles marques de ses inventions dans l’architecture qui comme m’ont dit de ses amis luy faisoit passer des nuits entières a reuser (?) sur quelque partie d’un nouveau desseing. Cette (?) application continuelt est ce qui luy a abregé ses joux.’ My thanks to Louise Rice for the transcription.
came late to Michelangelo himself, when in reforming the architecture of the great church of St Peter’s he was pilloried for the new forms and ornaments.72

It is easy to see why Borromini looked back to Michelangelo as a model of imaginative courage, and why Plumbier should look back to them both. To the ornamental turner trying to justify emancipation from the bondage of rule, these artists must have seemed like apostles of freedom.

But was the exchange reciprocal? There are three types of evidence that Borromini, at least, did draw inspiration from the culture of turning. First, he resorted to the lathe in at least one commission, and explained clearly why. Second, there are close affinities between Borromini’s art of mouldings and the turner’s art of profiles. And third, an unusual metaphor once used by Bernini to describe Borromini seems to make sense only in the light of Kunsttrechsel.

The tall, lithe, balusters that line the Vallicella Library and support the upper walkway were all turned on the lathe (Pl. 26b). The original contract had specified 44 Tuscan columns, ‘il tutto fatto al tornio eccetto la cimasa del capitello, et architrave, che vanno quadrati, et isolati.’73 But just as the carpenter was about to begin the job Borromini rethought the problem, and explained why in the Opus:

I was finally enlightened by Signor Felippo [sic, actually Luigi] Arigucci, a Florentine gentleman and a great expert in this profession, who inspired me to depart from the orders of architecture by using balusters, which can be made with any degree of thinness and variety of work, and which break the tedium of the elevation. He made me aware of the example of a tomb of a Grand Duke of Florence designed in this way. So I made up my mind to follow his suggestion, and I avoided the flaws of the columns, since the balusters turned out to be elegant (gentili) but do not block the view.74

Turners could do the canonical orders, but to demonstrate the perfection of their art they had to tempt Borromini ‘to depart from the orders of architecture’ and instead to use balusters, which could be shaved down to ‘any thinness and any variety of work’ and which relieved the tedium of the elevation. Here the architect has definitely turned turner. These giant staffs, each made in three separate pieces, belong to the same world as the bedpoles, andirons, and other pieces of elegant furniture produced in some quantity in seventeenth-century Italy before cultivated taste began to tire of the lathe. They show us that Borromini knew how to use the

72 Opus Architectonicum, preface (MS, fol. 3r): ‘et io al certo non mi sarei posto à questa professione col fine di essere solo copista, benché sapessi che nell’invenzor cose nuove non si può ricever il frutto della fatica, se non tardi, come non ho ricevute l’estesso Michelangelo, quando nel riformar l’architettura della gran Basilica di S. Pietro, veniva lacerato per le nuove forme et ornati ...

73 Connors (as in n. 56), p. 151, doc. 186, 1643, September 20.

talents of the men working along the Via dei Catinari. But they are not Kunst-
drechsleu. For the influence of artistic turning one must look not to carpentry but to
stonework, in particular to Borromini’s art of mouldings.

Plumier introduces Borromini in his chapter on profils, the complex mouldings
which ornamental turners manipulated like the letters of the alphabet to form the
words and sentences of their art (Pl. 27d). Although it was typical for a baroque
architect to pride himself on his modinature,75 none was ever so complex as those
invented by Borromini (Pl. 27b). The plates of the Opus Architectonicum and the
Studio d’architettura civile show the geometrical basis underlying these intricate forms
(Pl. 27e).76 The portals of the Oratory, for example, have wonderfully expressive
mouldings full of delicate curves and countercurves and deep undercuttings. The
oval window over the main entrance is hollowed out along its rim like the wheel of a
lathe-turned pulley (Pl. 27a). The craftsmanship involved in these doors was ex-
pensive, and it came from forcing scarpellini to work with all the subtlety of turners.
Deeply undercut, sinuous, strangely symmetrical around a central ridge, Borromini’s
modinature are showpieces of his art and also the place where he comes
closest to the creative mentality of the ornamental turner.

Finally, when Bernini was once asked by Virgilio Spada to describe Borromini,
he answered with a metaphor that would be difficult to understand without
knowing something of the ars tornandi. Bernini said that Borromini alone under-
stood the profession of architecture, ‘but that he was never satisfied, and that he
wants to hollow out one thing inside another, and that inside another, without ever
coming to an end.’77 The images that this remark calls to the modern mind are
Russian dolls or nestled Shaker boxes. But if we want to avoid anarchism we must watch
over the shoulder of the baroque turner, hollowing out one little ivory ball
inside another, inside which stars or vases of fantastic shapes were turned with
incredible skill, like ships in a bottle (Pls 25a, b, 28b). In effect, Bernini is com-
paring Borromini to a turner shaping a Contrefaitkugel. The metaphor captures
something important. Inspired by the double-shell structures of Milan, especially S.
Lorenzo Maggiore, Borromini would design S. Carlino as a shell within a shell, a
screen of columns set inside a quatrefoil plan that is itself plastically moulded to fit
inside the box of the outer walls, una cosa cavata dentro l’altra, e nell’altra l’altra. In
part Bernini’s phrase is a grouch complaint about an obsessive rival, but it is also a
perceptive image of a mind that revelled in the involuted and the intricate.

To judge by the testimony of Plumier and other writers turning was cultivated by
the leisureed classes all over Europe up to the middle of the eighteenth century.
By the age of the Encyclopédie, however, the lathe had reached another fork in its
millennial history. We are about to leave what historians of technology call the

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75 See Martino Longhi the Younger, Epilogo di arckitettura, Bracciano 1625, p. 19: ‘E chi non ha
veramente tra l’altre scienze quella del modinare, che è
tanto necessaria, non si può dire Architetto.’
76 Opus Architectonicum, ed. S. Giannini, Rome 1725,
pls xii, xiii, xiv, xxii, xxiv, xxi, xxxiv, xxxvi, lli, lvi, and
Domenico de Rossi, Studio d’architettura civile, i, Rome
1702, pls 70, 82, 83, 84, 88, 94, 98, 101.
468: ‘... nondimeno il medesimo Cavaliere Bernini per
verità disse a me molti anni sono avanti l’altare di
S. Pietro che il solo Borromino intendeva questa
professione, mà che non si contentava mai, e che voleva
dentro una cosa cavare un’altra, e nell’altra l’altra senza
finire mai’ (J. Connors, ‘Virgilio Spada’s defence of
‘by-path of ornamental turning.’ 78 In the treatise of 1775 by Hulot, ‘Maitre Tourneur & Mécanicien brévété du Roi’, the lathe is described as essential for all the details and furnishings of architecture. 79 Yet to Hulot the tool seemed hopelessly lashed to the aesthetics of the dying baroque. He criticized turners (‘les moulures ont de mauvaises formes, leurs assemblages sont barroques’) and urged them to abandon their gothicism and to absorb the bon goût of the new classical style in architecture. He envisaged the reformed lathe as a servant of neoclassicism. What would count in the new turnery is not so much the form of precision of workmanship. In 1792–96 a Parisian merchant named E. L. Bergeron, who sold lathes and all sorts of scientific instruments, published the monumental Manuel du tourneur, actually written by Louis Salivet. 80 These stout volumes explain in a cool didactic tone everything the apprentice might want to know about turnery; they could easily be followed today by someone with patience and the right tools. All the usual examples of virtuoso turnery make an appearance, but raised to a new degree of mathematical complexity, like stars (with up to twenty points) embedded inside hollow polyhedrons (up to the icosahedron). But ornamental turnery is not the main point of the manual. Citizen Bergeron’s heart is not so much in the exotic products of the lathe as in the wondrous complexity of the machines themselves. French and English workshops were already producing the industrial and especially the metal-cutting lathes that would power the factories of the nineteenth century. 81 Indeed, as an art form ornamental turnery would scarce outlive the French Revolution, hanging on only in the backwaters of aristocratic privilege. 82

Clusters of ideas can cling to a tool and survive in workshops long after they have been snuffed out in more academic settings. 83 Ideas about freedom from inherited convention, the importance of the imagination, and the supreme role of the individual genius must have been widely current in Italy during the formative period of baroque architecture, yet few people bothered to write them down. 84 They were the star by which Borromini set his sail, and they moved him to outbursts like ‘I would never have entered this profession only to become a copyist.’ Yet such

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78 Woodbury (as in n. 3), p. 58.
79 M. Hulot (père), L’art du tourneur mécanicien (Académie Royale des Sciences de Paris, Descriptions des Arts et Métiers, 43), Paris 1775, especially the preface, and pp. 57–68.
80 Bergeron (as in n. 47).
81 Woodbury (as in n. 3), pp. 73ff.
82 In Tolstoy’s War and Peace (trans R. Edmonds, Harmondsworth 1978, pp. 99ff, a passage I know thanks to the kindness of Françoise Connors) there is a portrait of an old general, Prince Nikolai Andreyevich Bolkonsky, who spends his retirement on the family estate writing his memoirs, solving problems of higher mathematics, working on the buildings and gardens, and turning snuff-boxes on the lathe. When his daughter visits him in his study this is what she sees: ‘The prince was working at his lathe, and after glancing round went on with what he was doing. The great room was full of objects evidently in constant use. The huge table covered with books and plans, the tall, glass-fronted bookcases with keys in the locks, the high desk

for the prince to write at while standing up, on which was an open manuscript-book, and the carpenter’s lathe with tools laid ready to hand and shavings scattered around—all suggested continuous, varied, and regulated activity. The motion of the small foot shod in a Tartar boot embroidered in silver, and firm pressure of the lean sinewy hand showed that the prince still possessed the tenacious strength and vigour of a green old age.’ Prince Bolkonsky’s hobby seems to be an afterglow of a movement started by Peter the Great’s translation of Plumier’s L’art de tourner into Russian.
83 For a study of ‘the personalities of tools’, see Baxandall (as in n. 15), pp. 27–48.
84 See however the comments interspersed throughout Passeri’s lives, for example J. Hess, Die Künstlerbiographien von Giovanni Battista Passeri, Leipzig and Vienna 1934, pp. 225ff, where there is praise for the architect who knows how to ‘prendere licenza d’uscire da quelle misure assegnate, e da quelle proporzioni prescritte.’
ideas rear their head in academic art theory mostly to be snubbed, scolded, refuted and finally laid to rest. New ideas that came into the practice of architecture from the world of the carpenter and the turner tended to meet with a steady resistance degenerating to scorn by the later seventeenth century.\textsuperscript{85} French theory is still more academic than Italian. From Fréart de Chambray to d'Aviler and Blondel we hear of little else but rule-governed discipline and imitation of the antique. There is little in these cold treatises of the heated conversations in which the generating ideas of baroque architecture were worked out.

Bernini was fortunate enough to have a Chantelou, but Borromini found no faithful recorder and thus remains almost totally silent for us. Martinelli paints a sympathetic picture of him in his guidebooks, but there was never anyone systematic enough to record the flood of ideas which crowded in on him as he passed entire nights working obsessively on his drawings. Such ideas survive only as nuggets in guidebooks and aphorisms taken down by chance. Ghosts that flitted around drafting rooms and workshops, they can be summoned up by resurrecting the tools that they haunt, like the lathe. Even if the plebeian tornitori turning out bowls and balusters along the Via dei Catinari cannot speak to us, we can still eavesdrop on the conversations that went on around the lathes of the ornamental turners, and embedded inside them are echoes of other conversations held between gifted architects. This is a spirited if fragmentary discourse. In it rules are belittled while invention and originality are praised in fulsome terms. 'The best lessons are those of the architect's own genius' was repeated down the generations; it was a rallying cry, and not just a well turned phrase.

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\textsuperscript{85} For example Bellori's marginal note in Ragione, \textit{Le vite}, p. 112; and Pascoli, \textit{Le vite}, ii, pp. 555–59.

\textbf{APPENDIX}

\textbf{THE LATHE AND CARAMUEL’S THEORY OF ARCHITECTURA OBLIQUA}

The baluster is the place where architecture and turnery overlap. Balusters never occur in ancient architecture but they are found in ancient furniture, for example, in brass and ivory bed legs.\textsuperscript{1} Renaissance sculptors like Donatello, Verrocchio and Pollaiuolo revived the form in bronze sculpture, and it soon achieved a revered place in the architecture of men like Giuliano da Sangallo. But classical theorists often felt uneasy with the ‘blossom of the wild pomegranate’ (from which the baluster took its name). Itself turned on the lathe, it threatened to unleash the loose and easy habits of turnery into architecture in an area where there were no ancient precedents to act as a control. Both Sannicoli and d’Aviler are concerned to chart rules for beauty in the design of balusters, and the former pauses in this section of his treatise to inveigh against the innovators.\textsuperscript{2} Borromini used the baluster as


\textsuperscript{2} Michele Sanmicheli, \textit{Li cinque ordini d’architettura civile}, ed. Alessandro Pompei, Verona 1735, p. 98;
a demonstration piece for novel forms which are still, for all their unconventionality, based on Nature. But the great innovator in baluster design was Juan Caramuel de Lobkowitz, the mathematician and theologian who spawned the theory of *architectura obliqua*.

Caramuel first came upon the germ of *architectura obliqua* in 1624, when he was still a young Cistercian student in Salamanca. Something in a new chapel that his order was building sparked the idea off, and he nurtured it during all the years of his travels, finally publishing it in his old age in 1678. *Architectura obliqua* is a theory of distortions based on perspective in which the members of architecture are reshaped according to their position in a building or their appearance to the spectator. Squares become rhombuses and circles ovals, and cubic or cylindrical forms are bent in three dimensions. A key example of the transforming power of *architectura obliqua* is the baluster. Orthodox theory (*architectura recta*) called for identical balusters on all parts of a staircase, both landings and steps. Caramuel insisted instead that the balusters on the rising flights should be deformed so that all their rings and mouldings lie parallel to the inclined plane of the flight and not parallel to the ground (Pl. 27c). By analogy staircases that employed a columnar order should have all the columns, bases and capitals inclined on an angle. Any other solution (like the little wedges that take up the difference of angle in most balustrades and staircases, especially in the colonnade of Bernini’s Scala Regia) was incorrect. In a world full of compromises, Caramuel demanded complete consistency in a totally plastic architecture that was subservient to the axioms of projection.

Oblique balusters are rare in architecture, but they are common by-products of the lathe. Besson in 1578 and de Caus in 1615 both show a turner cutting an oblique baluster (Pls 23a, b). The machine allowed a kind of practical oblique projection that demanded no elaborate calculations on the turner’s part. The turner could hold his tool fixed to cut a moving stuff, sped back and forth by spindles moving longitudinally along their axis. Or alternatively, adjustablecams set an angle to the spindles moved either the stuff itself or a tool guidebar to produce intricate oblique profiles. The skill was built into the machine. Besson’s print (Pl. 23b) shows many vases and other products cut in oblique forms lining the turner’s shop. But for Caramuel, there such curiosities might have stayed. However, the Spanish monk’s early observations of balusters were fanned in the dry tinder of a mind schooled in logic and anamorphic projection until years later they blazed into a completely consistent but heterodox theory of architecture.

Guarini criticized *architectura obliqua* on the grounds that, if a staircase were actually built according to Caramuel’s rules, the oblique columns would slip off the oblique bases as soon as any weight was put on them. Guarini is obviously right. But turners thought in terms of

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3 ‘Balaustr ... i quali da nostri Italiani de’ buoni secoli ottimamente inventati, et perfettamente in uso posti, furono poscia corrotti e guasti e resi deformati dagli altri Italiani, che dopo vissero’; d’Aviler (as in n. 51), i, pp. 318–23.

5 Connors (as in n. 56), pp. 119 and 227f. In Opus, vi, p. 20'. Borromini says, ‘Ne senza misterio ho fatto i balaustri triangolari, e piantatoli uno contrario all’altro ... sapendo che molti che non sanno inventare hanno creduto esser stato mero capriccio, et essere improprio che una parte di essi balaustri sij piu grossa di sopra che da piedi non avertendo che la natura (qual doviamo imitare) sicome produce g’arbori piu grossi da piede che di sopra, cosi sa fatto l’huomo piu grosso di sopra, che da piedi.’ Here he is directly contradicting Palladio’s dictum that walls, like plants, should grow thinner and lighter as they rise (A. Magrini, *Memorie intorno la vita e le opere di Andrea Palladio*, Padua 1845, pp. 54ff).


5 J. Besson, *Theatrum Instrumentorum*, pl. vii; and Caus (as in n. 7 above), bk. i, prob. xxi, pl. 28. Both are illustrated and explained in Woodbury (as in n. 3 on p. 217), p. 59ff, figs 20 and 21. See also Bergeron (as in n. 47), ii, p. 122 and pl. xi (‘un balustre rampant’).

entire systems cut from a single piece of stock. They were taught, for instance, to cut miniature architectural orders, complete with base and capital, from a single stuff. Since the division between base and column was purely illusory, it would never have occurred to a turner that the pieces could slip apart, any more than that slippage might occur between the halves of a baluster. By extrapolating from miniature turnery in wood to monumental architecture in stone Caramuel evolved a beautiful and unconventional theory, but he completely missed the structural dangers of obliquity.

7 A late example of the practice in Bergeron (as in n. 47), i, pl. xxx; ii, pp. 186ff. and pls xviii and xx.
a—Sixteenth-century lathe with template bar and oblique cams (pp. 218, 235)

b—Sixteenth-century lathe with oblique cam (pp. 218, 235)

c—Bow-lathe with crankshaft (from Plumier, L'art de tourner, 1749) (p. 219)

a, b: from Besson, Theatrum instrumentorum, 1582
b. c: Florence, Museo degli Argenti

b—Turned ivory (p. 224)

c—Contrefaît (p. 220)

2—Daniele Crespi, Portrait of Manfredo Setala.

Milan, Pinacoteca Ambrosiana (p. 221)
a—Turned ivory. Vienna, Kunsthistorisches Museum (p. 223)

b—Turned ivory from the collection of Nicolas Grollier de Serviere (from Plumier, L'art de tourner, 1749) (p. 223)

c—Turned ivory. Florence, Museo degli Argenti (p. 223)
a—Nineteenth-century lathe. Hancock, Mass., Shaker Village (p. 219)

b—Borromini, balusters. Rome, Biblioteca Vallicelliana (p. 231)

a—Borromini, facade portal, Rome, Oratorio dei Filippini, 1641, detail of mouldings (p. 232)

b—Borromini, pilaster base, Rome, S. Giovanni in Lateran, 1646–49 (p. 232)

c—Caramuel de Lobkowitz, studies of oblique balusters (from his Arquitectura civil, 1678) (pp. 218, 235)

d—Profiles for the turner (from Plumier, L’art de tourner, 1749) (p. 232)

c—Borromini, convent portal at S. Carlo alle Quattro Fontane (from De Rossi, Studio d’architettura civile, 1702) (p. 232)